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Foresights, scenarios and sustainable development – a pluriformity perspective

Research Memorandum 2013-17

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FORESIGHTS, SCENARIOS AND SUSTAINABLE DEVELOPMENT – A PLURIFORMITY PERSPECTIVE

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Abstract

This paper is concerned with future sustainable development strategies from a stakeholders' perspective. The paper reviews various sustainable development contributions and addresses also various methodological issues pertaining to sustainable development. The literature review lays the foundation for the operational analysis in this paper. Based on a multidimensional indicator system, reflecting a pluriformity in approaches and viewpoints, a systemic perspective based on a multicriteria model is proposed against the background of an 'amoeba' diagram. By means of this model, a set of local or regional empirical case studies is presented originating from five European countries, namely Italy, Spain, Romania, Finland and Scotland. To map out and analyse sustainable development of the areas under consideration, we develop four scenarios (Competitiveness, Continuity, Capacity, and Coherence) for each of these five European cases, and evaluate these cases on the basis of viewpoints of relevant stakeholders regarding future sustainable development. These scenarios are next systematically assessed with a view to the identification of the most preferred future. Our results indicate that in general the most preferred sustainable future is formed by the Coherence scenario, in which ecological and social factors are the most influential sustainability factors.

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"If everybody in this world of ours were six feet tall and a foot and half wide and a foot thick (and that is making people a little bigger than they usually are), then the whole of the human race... could be packed into a box measuring half a mile in each direction...

If we transported that box to the Grand Canyon of Arizona and balanced it neatly on the low stone wall that keeps people from breaking their necks when stunned by the incredible beauty of that silent witness of the forces of Eternity, and then called little Noodle the dachshund, and told him... to give this unwieldy contraption a slight push with his soft brown nose, there would be a moment of crunching and ripping as the wooden planks loosened stoned and shrubs and trees on their downward path and then a low and even softer bumpity-bumpity-bump and a sudden splash when the outer edges struck the banks of the Colorado River.

Then silence and oblivion!

The human sardines in their mortuary chest would soon be forgotten. The canyon would go on battling wind and air and sun and rain as it has done since it was created.

The World would continue to run its even course through the uncharted heavens. The astronomers on distant and nearby planets would have noticed nothing out of the ordinary.

A century from now, a little mound, densely covered with vegetable matter, would perhaps indicate where humanity lay buried.

And that would be all."

H.W. van Loon, *Van Loon's Geography, The Story of the World We Live in*, Simon & Schuster, New York, 1932, pp. 3-4

1. Focus on Futures

“Worldwide, there is only a market for five computers”.

Thomas J. Watson, President-Director IBM, 1958

‘If... then...’ is a conditional proposition that describes precisely a logical causal statement on possible future events. Obtaining due insight into an uncertain future has been a permanent source of rational speculation in the history of mankind. In the Hellenistic period, the foundation for systematic foresight analysis was laid already by the Oracle of Delphi which – in contrast to popular wisdom – was not based on incoherent exclamations of an ancient intoxicated goddess, but on evidence-based information collected by her through listening to subordinates of any political figure who wanted to get a useful hint on how to face the future. The medieval and pre-modern literature was also full of seemingly rational attempts to predict uncertain future events, such as catastrophes or wars. The aim to acquire political power was often an inspiration for obtaining strategic future information on unknown territories, as is clearly reflected in the support of leading dynasties in European countries for the great discovery trips from the fifteenth to the eighteenth century.

The control of future circumstances that might adversely affect current or future economic or political developments has over the past decades led to many scientific efforts to uncover the driving forces of potential drastic changes in the nearby or distant future. One of the first well-documented studies on future developments can be found in Kahn and Wiener (1967), who made a scientific analysis of the bandwidth within which the year 2000 could be rationally explored (‘a framework for speculation’). Their investigation was inspired by control principles derived inter alia from cybernetics. The application of advanced modelling experiments was in particular advocated by Tinbergen (1956), who was able to construct system-wide models for economic policy and forecasting. Early attempts to offer national forecasts on the success conditions of economic systems were also made by Ayn Rand (1957). In subsequent decades similar attempts were made, inter alia by Alvin Toffler (1970), whose foresight analysis was mainly based on collecting a wealth of (sometimes selective) trend information to map out the contours of likely future mega-trends. The scientific interest in future development has even led to a new orientation in the planning discipline, sometimes coined futurology. In our modern era the exploration of possible futures has led to a great popularity of scenario analysis, for instance,

in the energy, environmental or transportation sector (see e.g. Nijkamp et al. 1998, Giaoutzi et al. 2011).

The debate on a sustainable future has indeed prompted a renewed interest in the contours of – and the conditions for – environmentally-friendly developments that might ensure a durable use of the earth's scarce resources. The concern about social, economic and environmental sustainability dates back to the end of the 1980s, with the publication of the WCED report on '*Our Common Future*' (1987) (often called the Brundtland Report). But its origins can be found already earlier in the post-war period, while very early attempts to address environmental and future issues in the social sciences can be found a few centuries back. A few illustrations will be offered here to indicate the interest of earlier scholars in ecologically-benign developments.

The trade-off between own interests and others' interest can already be traced in one of the great philosophers and the founding father of modern economics, Adam Smith, who in his '*Theory of Moral Sentiments*' (1759) introduced the concept of a '*man of humanity*' to illustrate the tensions between the present and the future. This man hears about an unprecedented earthquake in China and then reflects for a while on the transience of life, and thinks also of the economic consequences for Europe and himself. But then he returns to his normal business. However, if he on that day were to be told that he was to lose his little finger in the near future, he would be tormented at all times and would find no peace. Adam Smith then puts forward a moral dilemma and asks: "*If the injury to or loss of the finger is subjectively so great a catastrophe and the earthquake in China such a minor one, would this mean that the 'man of humanity' would prefer the obliteration of millions to the rescue of this little finger if such a choice existed?*"

Self-interest has over the past decades been the foundation of economic behaviour. But it prompts questions on how to handle effects of actions that influence someone else's well-being without being included in market or price transactions. A well-known example from the early days of the steam engine is the locomotive whose sparks may set in fire the crops cultivated by farmers in land adjacent to railways. Clearly, full compensation costs would have to be paid by the railway company, but as a consequence, more farmers would grow crops near railways, as this might give them a guaranteed income in case of fire, irrespective of the probability of crops being destroyed by bad weather. This situation might lead to a misallocation of scarce resources, as normal entrepreneurial risk would not be included in these transaction costs. To take account of such externalities in the market system, Pigou (1930) introduced the notion of a financial compensation through the principles of taxation, so that all (direct and indirect) costs would be incorporated in the '*measuring rod of money*'. This principle has played a prominent role in

environmental policy, where it is nowadays known as the ‘*polluter pays principle*’. Would the market system then be able to ensure a sustainable future?

In the post-war thinking on environmental, resource and climate issues various stages can be distinguished:

- the intuitive phase, where mainly anecdotal evidence was presented on environmental decay. A clear example is Rachel Carson’s ‘*Silent Spring*’ (1962);
- the systemic phase, where population, resources, environment and growth were analysed from a global systemic perspective. An illustrative contribution is the study of Meadows et al. (1972) on ‘*The Limits to Growth*’;
- the sustainability phase, where the long-run balance for the use of the earth’s scarce resources was put in the perspective of both the future and the North-South interests. The seminal study of WCED (1987) heralded a new epoch in environmental thinking. But also at a local and regional scale, various analytical studies on sustainable futures were undertaken (see e.g. Giaoutzi and Nijkamp 1994);
- the climate change phase, in which as of the beginning of the 21st century the focus has been directed towards long-range climatological changes at a worldwide scale.

These global developments have prompted many innovative concepts and policies for a balanced development of our planet. But also at local levels, various initiatives have been launched, such as the sustainable city initiatives (see Nijkamp and Perrels 1994).

In many environmental economic policies at various spatial levels, price and market perspectives have played a dominant role. Market-oriented sustainability policies have largely adopted similar principles, e.g., in resource policies, in emission rights policies etc. This strategy has meant a powerful policy contribution to the achievement of environmentally-benign future developments, and constitutes also a critical part in the implementation of the Kyoto Protocol and subsequent initiatives.

Nevertheless, there are many cases where a straightforward price and market principle on future sustainable developments may be problematic, especially at local or regional levels where areal development is more based on a commonly accepted, multi-stakeholder future perspective – leaving space for much pluriformity in viewpoints on sustainable trajectories – than on a strict system of price or tax incentives. The main issue is then whether under such conditions a sustainable future can be mapped out and ensured.

In the present study, we will adopt a future scenario approach to take care of the sustainability interests of local or regional development plans, in which local or regional stakeholders have an important say. The aim is thus to test the feasibility of scenario analysis for

local or regional sustainable development strategies, using the viewpoints of relevant stakeholders as main anchor points for our analysis.

This paper is organized as follows. In Section 2, we will outline various elements of a sustainable future. Next, Sections 3 and 4 are devoted to the description of various future scenarios, to be applied in five case study areas in Europe. A description of the methodology and of the main findings is offered in Section 5, followed by a concluding section.

2. In Search of a Sustainable Future

“Doubt is not a pleasant situation, but certainty is absurd”.

Voltaire (1694-1787)

An avalanche of studies has been published on sustainable development. Many of them have a global or national orientation, while others are more instrumental and policy-oriented in nature. There are also many sectoral-oriented sustainability studies, while we observe an increasing number of spatial sustainability studies, e.g., on sustainable cities or regions.

Sustainability is a hard-to-define concept, but it became popular and very much ‘en vogue’ after the publication of ‘*Our Common Future*’, also known as the Brundtland Report by WCED in 1987. According to this report, sustainable development refers to a development of countries or regions that meets the needs of the present without compromising the ability of future generations to meet their own needs (WCED 1987). Sustainable development is not only limited to environmental aspects, but also includes other developmental issues, such as socio-economic objectives.

Given the fact that sustainable development has a very complex nature from a policy and process perspective, a systemic approach may offer a practical frame of reference. In general, a systems approach aims at portraying the processes and relationships in a complex system that encompass various components which are mutually connected by means of functional, technical, institutional or behavioural linkages (Harvey 1969). Systems thinking advocates the scientific treatment of systems as interlinked units, composed of mutually related elements. According to Hwang (2000), systems thinking enables us to see the overlapping and ever expanding relationships among multi-faceted systems in multiple dimensions, ranging from both problem formulation to problem solving in (organizational) practice. Moreover, Stewart and Ayres (2001) advocate a systems approach in policy making by emphasizing the following points:

- A systems approach offers policy makers a fresh set of perspectives on the integrated fundamentals of policy analysis.

- Policy design is as much a matter of choosing structures and relationships as of choosing instruments.
- Understanding causation means acknowledging two-way influences and the role of complicated feedbacks.

In developing a coherent approach on spatial sustainable development, we have to think first of all about policy-related factors. To favour or enforce sustainable development, appropriate policies, regulations and incentives are needed. However, governments and the focus of policies can change due to several (inter)national socio-economic shifts. But apart from such developments, also the nature of policies and the scope of governance may be important. For example, the level of coherence and seamlessness of political decisions is important to stimulate sustainable development. Efficient incentives, transparency of measures, sustainability goals in all policy fields, as well as regulatory tools can all be seen as factors necessary for success.

These factors can be even more important when the government has to look into the interests of private partners. Public-private partnerships can improve the understanding and trust on both sides and therefore, the uptake of new (innovative) ideas in the business environment, as well as in the public sector. However, this requires interaction between different policy levels (local, regional and national) and between public and private partners.

When thinking in business terms, trust and mutual understanding are very important to change entrepreneurial behaviour. This requires also insight into the behaviour of SMEs and into the structure of existing market networks. It should be noted that the economic structure including ownership issues, the presence of big international firms and the influence of local firms significantly affect the manoeuvre space for sustainable development. In addition, not only the current economic structure, but also the current and future economic business climate is relevant.

It should be added that innovation and change partly depend on social values, social acceptance and absorptive capacity of society. When entrepreneurs and households are aware of the importance of sustainable development, and if they are open to new ideas, then this may induce new developments that are promising for a sustainable future. In addition, also local leadership is an important success factor. Another important aspect of sustainability is the operational and visible quality and quantity of ecological areas and the ecological processes taking place. Synergies between protecting natural/cultural heritage and economic development of tourism and land-based industries can also enforce sustainability success ranging from local to global scales. Moreover, insights into the current state and resilience of local/regional

ecosystems as well as insights into (economic) benefits of ecological values can help decision-making and stimulate balanced sustainable development at various geographical scales.

In our empirical approach described in Section 3 and subsequent sections, we follow a stepwise approach:

- Design and definition of four sustainable development scenarios at a local or regional level, on the basis of five case studies in Europe.
- Identification and assessment of the impacts of these scenarios using the systematics of a multidimensional ‘amoeba’ diagram (a visualized ‘impact matrix’).
- Elicitation of the interest of relevant stakeholders by developing a stakeholder’s priority scheme (‘weighting scheme’).
- Performance analysis of each scenario with a view to the identification of the best-fit scenario for a sustainable future, by means of a multi-criteria evaluation analysis.

3. Design of Systemic Scenarios for Sustainable Development

“As far as the laws of mathematics refer to reality, they are not certain; and as far as they are certain, they do not refer to reality”.

Albert Einstein

The key issues in applying the concept of sustainable development to the five case studies under consideration are the competitive organization of production and consumption (economic and social), the aim of continuity (institutional and ecological), the consideration of capacity (ecological and economic), and the need of coherence (social and ecological). Clearly, the application of the sustainability concept will lead to different analytical issues and outcomes depending on local circumstances and interests. Therefore, we have deliberately introduced a great diversity in case-studies from different countries in Europe. The aim of this approach is not to make a comparison of findings from different case-studies, but to test the robustness of our analytical apparatus by applying it to different experimental conditions. For this reason, we have consulted different types of stakeholders in five distinct case studies: the forest sector in Finland; a Scottish national park; the Romanian energy sector; a Spanish region addressing sustainable progress, and the agricultural sector in an Italian region. These case studies are meant to provide a complementary view of different sustainability problems in various geographical, environmental, social, economic, developmental and cultural contexts in order to test the potential value of our strategic scenarios for future sustainable development. Before presenting

the definition of scenarios and the methodology used in this paper, we will introduce briefly the sectors targeted in each case study.

Finland: The focus of the sustainability case study in Finland is on the ecosystem and its utilization of forest by humans. This case study is a nation-wide case study for the next 20 years. It focuses on the forest ecosystem, and therefore, the plan covers ecosystem quality and ecosystem wellbeing of forest areas in Finland. The economic aspect of the case study is to analyse the possibilities to regenerate and sustain the ecosystem's quality.

Italy: The aim of this case study is to understand the complex interactions and metabolism of the agricultural sector in Italy. This study focuses on three spatial scales, viz. local scale (farm level, with three farms being selected), regional scale (Campania region) and national scale (Italy).

Romania: The focus of this case study is on the energy sector including the integrated social, economic and environmental aspects. This case study also focuses on the transitional economy at a sectoral level on the basis of the metabolism of the system in terms of its flows of energy, materials and money.

Scotland: This case study focuses on assessing the trends in the Cairngorms National Park (CNP) in Scotland and the implications for this park from the National Park Act via the Cairngorms National Park Plan. The CNP Plan is a strategic spatial planning document that is structured around three main themes: conserving and enhancing the Park, living and working in the Park, and enjoying and understanding the Park. The Plan has 22 strategic objectives to be achieved by the year 2030, as well as 7 policy priorities for action to be achieved by 2012.

Spain: The target of this case study concerns the sustainable development of Catalonia. The aim is to test the possibility of carrying out the analysis of a metabolic pattern across geographic levels using also spatial analysis (data supported by GIS). The goal of this case study through quantitative results is to obtain new insights into technical challenges, the possibility of gathering the required data, and the policy relevance of the results.

In the next section, we will present the definition of our scenarios for the sustainable future of the areas concerned, while subsequently we will discuss the data used for this study.

4. Pluriform Scenarios for a Sustainable Future: Definition and Data Collection

4.1 Definition

This part of our analysis specifies the nature of the scenarios operationalized through the use of empirical stakeholders' questionnaires administered in each of the five cases. The different valuation of stakeholders suggests that there would be great diversity in sustainable futures. Consequently, we have developed four different scenarios with a high degree of pluriformity. These scenarios will now concisely be described.

- ***Scenario 1: Competitiveness (economic and social):*** The main aim is to reach sustainable development by first improving the economic situation. This means that apart from creating a satisfactory physical system (e.g., infrastructure), uncertainties in, for example, prices will be decreased and the economic diversity of sectors will be optimized. In this way, the economy will be less sensitive to economic crises and income will be more equally distributed. As a result, the quality of social networks will increase, while budgets and technologies are available for the protection of the ecological environment. This will then result in a stronger competitiveness and more sustainable economic development.

- ***Scenario 2: Continuity (institutional and ecological):*** Here the main aim is to protect the natural environment, as well as the diversity of ecosystems. Therefore, it focuses on the increase in ecological quality and the choice of environmentally-friendly sectors for economic development. In order to do so, there is a need for a high level of administrative and management involvement in terms of effectiveness of policies, sustainability inclusion, continuity and integration of institutional systems in the sector at hand and a respect for sustainability. Both continuity in the institutional system and developments related to the ecological system are indispensable.

- ***Scenario 3: Capacity (ecological and economic):*** In this scenario, the main aim is to obtain a high-quality natural environment, as well as a healthy economic and physical environment. By focusing on both economic and ecological development, the environmental capacity of an area will increase. Often these two aims can be integrated by using environmentally-friendly ways of production. This means that producers should not only choose environmentally-safer inputs for production, but should also reduce unnecessary waste and transport movements.

• **Scenario 4: Coherence (social and ecological):** The main aim is to first develop the social environment in terms of the quality of social networks, for instance, to increase the awareness of sustainable development in general (e.g., through education) and of the importance of ecological and social networks more specifically. Therefore, investments in education levels and skills to use new technologies are very important to both the young and the elderly generation. As a result, the level of tolerance and openness of society to new developments and the level of involvement and understanding will be increased. This will then lead to the protection of the ecological system and a decrease of negative environmental impacts.

These four scenarios will now be applied to each of our five case studies. To that end, a comprehensive systematic database is necessary.

4.2 Database

We have developed an online questionnaire to trace the different opinions among groups of stakeholders. A digital questionnaire was sent out to carefully selected stakeholders of the five case studies. The questionnaire took about 10 to 15 minutes to complete, and had the aim to collect a wide range of opinions and experiences regarding sustainable development from different stakeholders. The questionnaire consisted of four parts. First, we asked the respondents to express their views on the relative importance of five basic systems compared to each other (pair-wise comparison). Secondly, we asked them to rate various aspects of these five systems. The third part had four scenarios that described how to reach sustainable development. We asked the respondents to allocate 10 points over these four scenarios in order to express their priorities for these scenarios. Finally, we also asked a few personal questions.

In total, 172 questionnaires were filled out: 18 from Finland, 55 from Italy, 52 from Romania, 34 from Scotland, and 13 from Spain. As Figure 1 shows, the biggest group of respondents is associated with academia, especially in Italy. The second biggest group of respondents are those working for the government, in particular in Romania in connection with the energy sector. Most small and large private firms that responded are from Scotland and Romania. Furthermore, in Italy a relatively large number of small firms (farm owners in this case) has responded. The smallest group of stakeholders is the NGO group, which originates mainly from Italy and Scotland. We have also a group of so-called ‘others’, containing the stakeholders who did not fill out information on their own institution, but who did fill out the rest of the form. The category NA (not available), which consists of seven persons, did not provide any personal information (see Figure 1).

The next step in our future sustainability analysis will be a systematic treatment of all data, for each of the five case studies, each of the four scenarios, and each of the relevant policy parameters under consideration. This will be done in the next section.

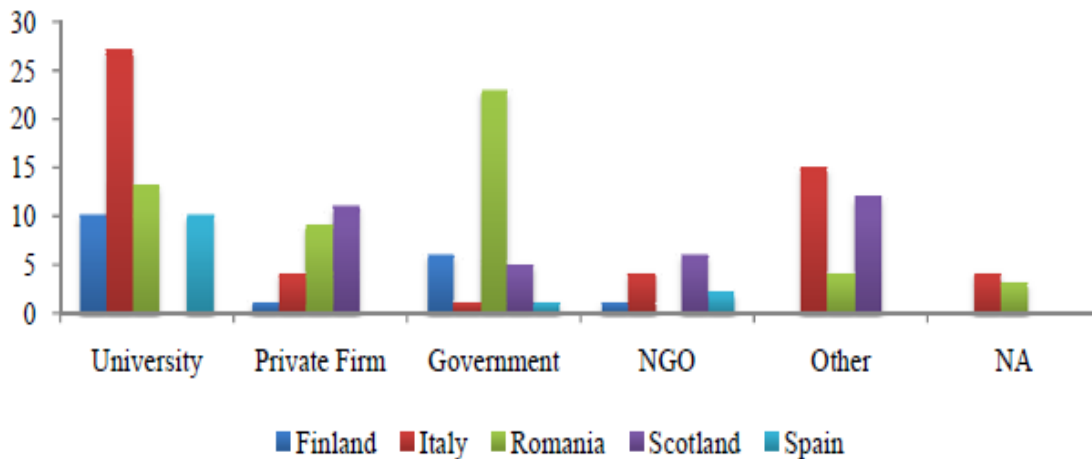


Figure 1. Distribution of stakeholders by institution and country

5. Methodology and Analysis

We have – as mentioned above – defined four distinct sustainable development scenarios in order to identify the best-fit sustainable development scenario, and to see which stakeholders prefer which scenario alternative and how they rank these on the basis of their perceptions and preferences. To that end, we will use an ‘amoeba diagram’ to map out the various positions. Next, we will apply multi-criteria analysis (MCA) to the results. MCA comprises various classes of decision-making approaches (see for a review Nijkamp et al. 1990). We will now concisely describe these two steps.

5.1 ‘Amoeba’ diagrams

The ‘amoeba’ diagram is based on a multi-attribute visualization of a composite phenomenon (e.g., a good, a person, a region). It takes for granted that in a comparative sense the most characteristic features of a phenomenon can be depicted in an amoeba-like diagram. The question how many characteristics will be included depends mainly on the aim of the research. In various policy studies (e.g., Capello et al. 1990), it has been demonstrated that in many cases five representative key factors can be distinguished that describe adequately the most critical attributes of a policy alternative. This is known in the literature as the so-called ‘pentagon’ model. In our empirical study on sustainable development strategies of the five European regions

under consideration, we are also able to distinguish five main drivers of sustainable development (see for details Akgün et al. 2011). The five ‘pentagon factors’ identified in our comparative case study approach are:

- economic factors
- ecological factors
- physical factors
- social factors
- institutional factors.

Clearly, we have now five pentagon factors, four scenarios and five regions, as well as multiple stakeholders. This means that we have different ways to represent the information in an ‘amoeba’ diagram, viz. by combining the pentagon factors with either the five regions or with the four scenarios, while priorities for each of the policy factors are obtained from relevant stakeholders. This is visualized in Figures 2 and 3, respectively (see for more details Akgün et al., 2011)

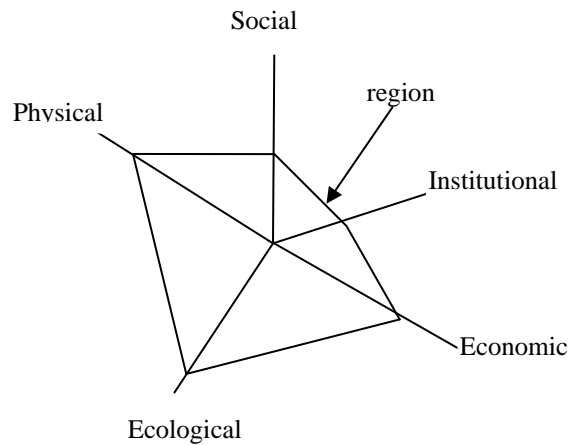


Figure 2. An ‘amoeba’ diagram for 5 pentagon factors and a given region

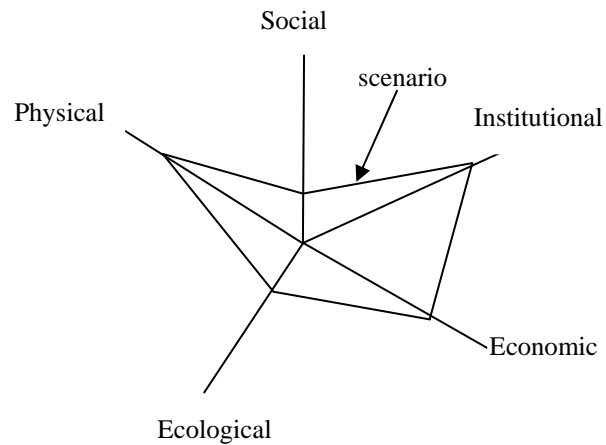


Figure 3. An ‘amoeba’ diagram for 5 pentagon factors and a given scenario

For the sake of illustration, we will present here some ‘amoeba’ pictures for our comparative scenario experiment by mapping out the empirical features of both the various classes of stakeholders on the basis of five pentagon factors (see Figures 4 and 5). Apparently, the differences between case-studies are larger than between groups of stakeholders.

Information on these five pentagon factors (in either a cardinal or a ranking system) allows us to use an MCA, in order to identify the most acceptable future scenario (through the use of preferences expressed by stakeholders) or the highest performing regions (or cases) for each of the individual future scenarios. This will be further discussed in Subsection 5.2.

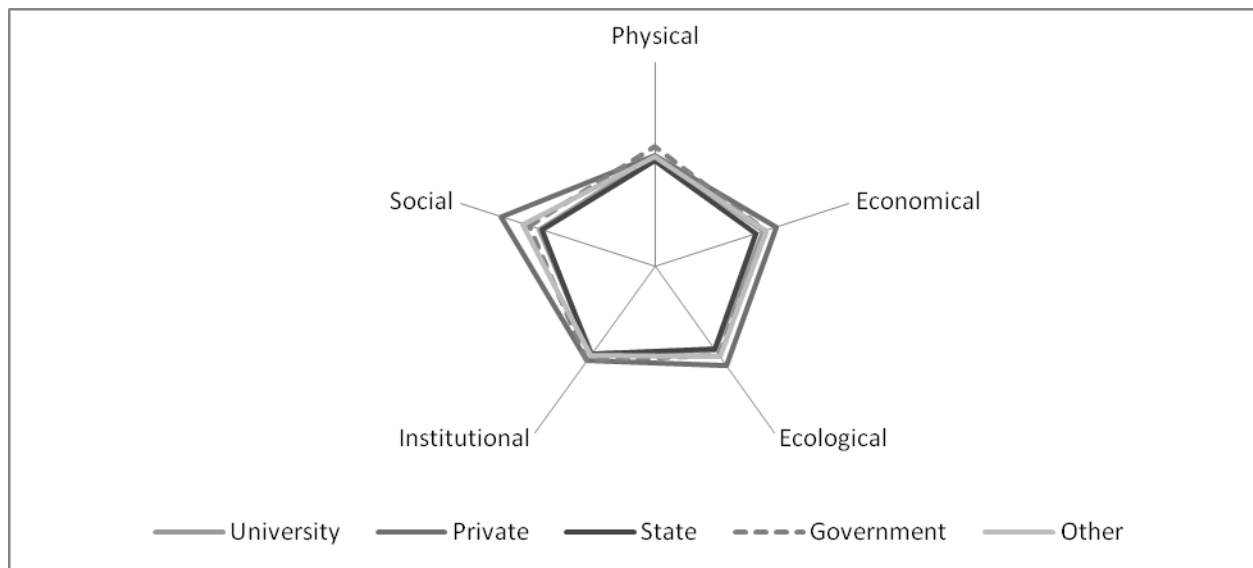


Figure 4. 'Amoeba' picture of pentagon factors by stakeholders' group

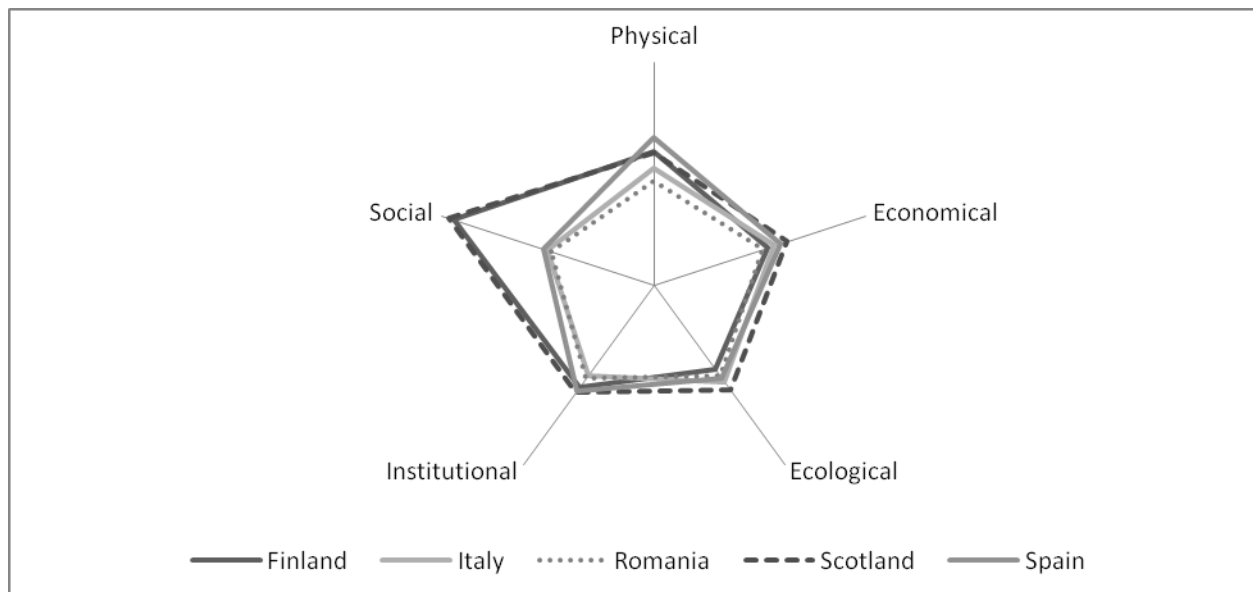


Figure 5. 'Amoeba' picture of pentagon factors by case study

5.2 A multi-criteria model

There are various MCA methods, but in this study we applied the regime method (see for details Nijkamp et al. 1990). The regime method presupposes a distinct set of a-priori defined alternatives and a distinct set of a-priori defined evaluation criteria. For all criteria together this then leads to a so-called ‘regime matrix’. Then, by adding a weight vector for each criterion, the relative dominance of each alternative can be assessed in the form of a performance (or success) indicator.

The scenarios differ in the relative importance of each of the five pentagon factors, as is shown in the ‘amoeba’ diagram. This information was also provided to the respondents. This basically forms thus the well-known MCA impact matrix. For instance, the most important factor for the competitiveness scenario is formed by economic systems. In other words, in the first scenario the main focus is to deal with the economic system to obtain a sustainable future. All other scenarios are also scored by means of these five critical factors in the same way (see for a full presentation in an ordinal format Figure 6Error! Reference source not found.).

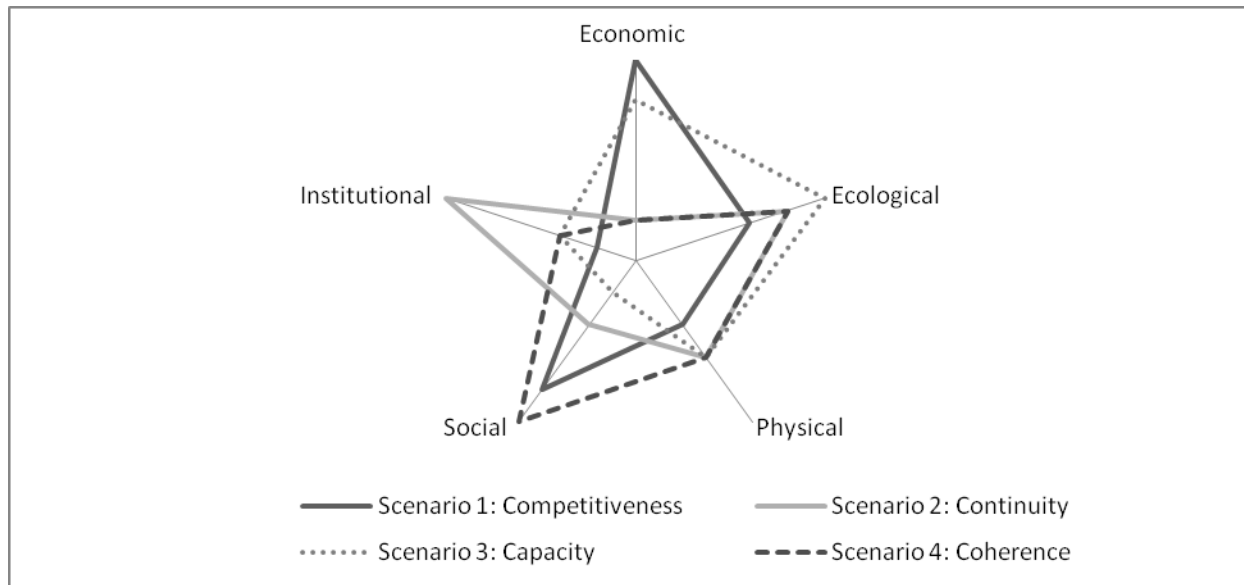


Figure 6. ‘Amoeba’ diagram of pentagon factors by scenarios

In order to prioritize the factors and understand their critical ranking, we have collected priority data from all stakeholders in the form of pair-wise comparisons. This allows us to calculate the weights for each factor from the perspective of a variety of stakeholders. Weights

calculated from the results of pair-wise comparisons form basically the prioritization rank order of the pentagon factors; and in the literature on regime analysis they are referred to as weights.

By using the weighted average of the pair-wise comparison of different stakeholders, we can generate a prioritization table of pair-wise comparisons, after which the ranking of the factors takes place. In our empirical work, this exercise allowed us to distinguish 11 sets of weights, i.e. priority rankings of the five pentagon factors (Table 1)¹. During the assessment of these groups, we used an ‘equally important’ ranking, when the stakeholders were not – or not entirely – consistent in their pair-wise comparison. In other words, when a stakeholder evaluates social systems more important than economic systems, economic systems more important than ecological systems, but ecological systems more important than social systems, this means that the ranking of the stakeholder is inconsistent (violation of ‘transitivity’ rule); then the relative weight of these factors is ambiguous, and consequently, all factors are equally weighted for this stakeholder. Apparently, he/she cannot decide which one is more important than the other. While constructing the weights distinction, we have thus three classes: ‘agree’, ‘disagree’, and ‘unsure’. We will now concisely interpret Table 2.

The first group distinguished in Table 2 (i.e. Group 1) is the one where all factors are equally weighted. All factors are thus equal in favour of sustainable development, both among higher-educated groups (high school and bachelor degree graduates) and lower-educated groups. Next, in terms of gender, both female and male stakeholders believe that ecological systems should be given a high priority; these categories are next followed by social systems and physical systems, which are equally important as institutional and economic systems. Among different stakeholder groups, we also included the general view by calculating the average mean of each stakeholder’s valuation and named it ‘general’. Thus, in general terms, without a differentiation of stakeholders groups, the same ranking as gender and master graduates is given and can be grouped as Group 2. We see almost the same grouping with the criticality of sub-factors of the pentagon factors. For instance, university and state employees have similar preferences, even when other occupations think different.

Table 1. Pair-wise comparisons – Set of weights

	Set of weights	Group of stakeholder
Group 1	Ecological=Social=Physical=Institutional=Economical	Education: Bachelor and High school or less Occupation: Students Institution: Other Country: Italy and Romania
Group 2	Ecology>Social>Physical=Institution=Economy	<i>General</i>

¹ The order of the groups has no meaning; they are in principle all equally important.

		Gender: Female and Male Education: Master Occupation: Other
Group 3	Ecology>Social >Economy>Physical > Institution	Occupation: Manager
Group 4	Ecology>Social> Institution > Economy >Physical	Education: Doctorate
Group 5	Ecology>Social>Physical>Institution>Economy	Occupation: Researcher
Group 6	Ecology=Social=Physical=Economy>Institution	Education: Other Institution: University and civil servant
Group 7	Social=Physical=Economy>Ecology>Institutional	Institution: NGO
Group 8	Physical>social>Economy>Institutional>Ecology	Institution: Private
Group 9	Ecology>Physical>Social>Institutional>Economy	Country: Finland
Group 10	Ecology=Physical=Institutional=Economy>Social	Country: Scotland
Group 11	Physical>Ecology>Economy= Social= Institutional	Country: Spain

On the basis of the stakeholders' prioritization table (Table 2) and the impact matrix (Table 1), we are now able to run our regime analysis. We have run the regime analysis for each group of pentagon factors separately and organized the table of the performance indicators – in the MCA case – for each group, so that we are able to identify the most preferred scenario from all stakeholders across all five case study areas (see Figure 7). In order to understand the performance of the four scenarios, the choices of the 11 groups of stakeholders are visualized in a histogram.

The numerical interpretation of the bars in the histogram of Figure 5 is as follows. The MCA software used in the regime methods is able to calculate in a cardinal sense (on a scale from 0 to 1 the maximum performance) the relative performance rates of each of the alternatives (e.g., scenarios), based on an underlying ranking system for the stakeholders' preferences for the five pentagon factors. This offers a rather robust quantitative outcome for the comparative analysis of our four scenarios. From the histogram we can easily observe that Scenario 4 (Coherence) is the most preferred one and Scenario 3 (Capacity) is the second most preferred. Scenario 2 (Continuity) and Scenario 1 (Competitiveness) next follow in the rank order, respectively.

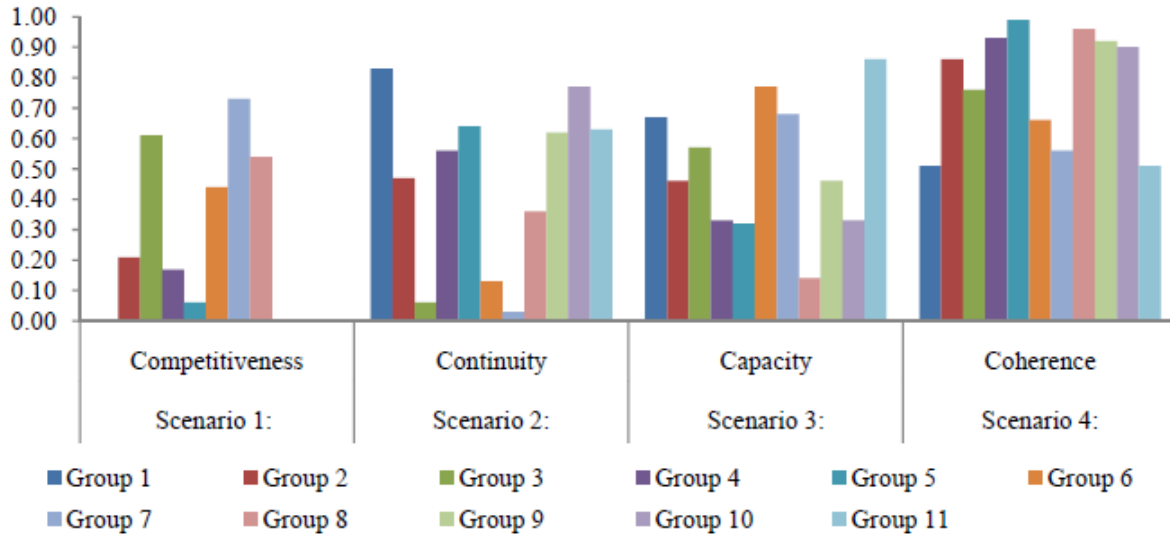


Figure 7. Scenario choices of different stakeholders

It is noteworthy that we can also observe some clear differences between the 11 groups. Scenario 1, for example, is in particular promising for groups 7 and 3, the NGO's and managers, but absolutely not for the first and the last three groups. In addition, it appears that stakeholders grouped by their geographical information do not prefer the first scenario, which stresses Competitiveness as a future sustainable development. These stakeholder groups have a relatively strong interest in a Continuity scenario.

According to the results of the regime analysis, the most preferred sustainable future appears to be the Coherence scenario (Scenario 4), in which ecological and social systems are attached more importance than other sustainability factors. While the third scenario, on Capacity, follows the Coherence scenario; here the most critical factors are economic and ecological factors. In addition, the scenario focusing on the ecological and institutional systems ranks as the third one, while the Competitiveness scenario which does not pay much attention on ecological systems is the least preferred sustainable future image.

On the basis of our stakeholders' preferences, sustainable future development appears to find much support for a basic concern on 'the ecological system', which is next mainly followed by social and economic systems. In other words, policies continuing or planning to focus on ecological aspects of future sustainable environments are strongly supported.

6. Concluding remarks

“The spam problem will be solved in two years”

Bill Gates (2004)

The previous foresight experiments on desirable future sustainability scenarios have demonstrated that a pluriformity perspective – with multiple stakeholders, multiple case studies and multiple strategic policy factors – offers a great potential for a systemic approach to ecological policy, against the background of economic and social factors. The rather unambiguous preference for ecological quality – among different regions and among different stakeholders – is an interesting sign of societal consensus formation, provided that information on choices is provided in a transparent and accessible manner.

Clearly, more solid research on such issues is still needed. In particular, a broad coverage of relevant stakeholders is needed, while also a broader set of empirical case studies would need due attention in follow-up research. And finally, the underlying database – expressed in five pentagon factors and underlying detailed case study data – might need more thorough attention.

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